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MORE BOX-MITES OF THE NORTHEASTERN UNITED STATES

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This is an unexpected addition to my earlier paper (15). At that time I thought I had secured all species of Phthiracaridæ of Connecticut. By collecting in new habitats (bogs, old pine woods) and new localities (the much more rugged northwest corner) I have to add several species to the New England list. Illustrations of species not yet figured will appear in the "Manual of East American Phthiracaridæ."

Since the publication of the earlier paper, Grandjean has introduced a new set of terms for some of the parts. (11). I am retaining mine (15, p. 221) as having precedence. The synonyms are:

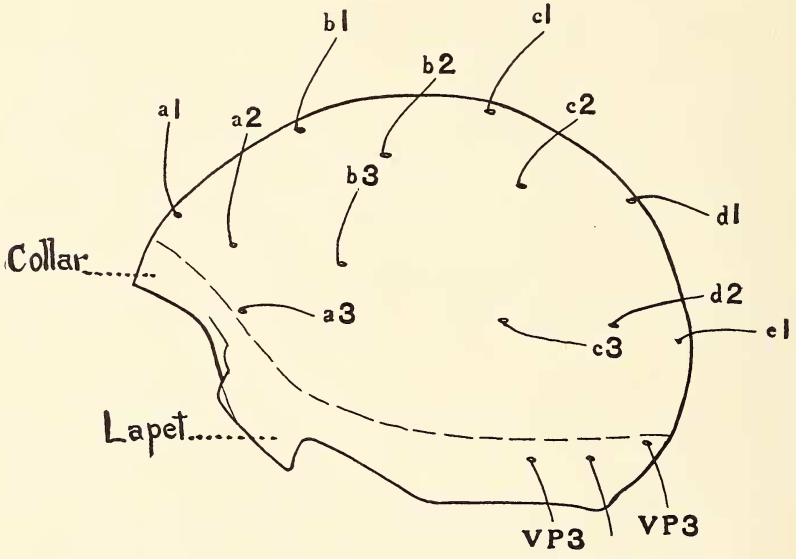
Jacot	Grandjean
anal rods	anal plates
anal covers	anal-adanal plates
genital shields	genital plates
genital covers	genital-aggenital plates
anogenital plates, in Oribotritia	adanal and aggenital plates
anogenital plates, in Pseudotritia	genital, aggenital, anal, adanal
infolded part of ventral plate	plicature plates

Following Oudemans, I regarded the complex of anogenital plates of Oribotritia as due to splitting of the plates as found in

Phthiracarus to give greater flexibility in a much contracted and much folded area. Grandjean considers the condition in Oribotritia as the more primitive and the one in Phthiracarus as due to fusion. As there is more evidence for accepting Grandjean's viewpoint than Oudemans' I will henceforth reverse the order of genera placing Oribotritia first and the Phthiracarini last.

I am still unable to find a suture between the outer part of the ventral plate and the part which is folded inward and which Grandjean calls, "plicature plate". As far as I can determine this is a sharply folded, V- shaped ventral plate.

Until the homology of the bristles has been worked out with some degree of certainty, I am retaining my notation of the notogastral bristles with the modifications stated in a more recent paper (16), which places the emphasis on the transverse arrange-



ment (text figure). This is in harmony with transverse segmentation, while the longitudinal arrangement inaugurated by Berlese in other genera has no phylogenic basis. The notation of the bristles of the anal area in the Phthiracarini, as used by Grandjean is as follows:

Jacot	Grandjean
—	a1 (a = anal)
I : 1	a2
I : 2	a3
II : 1	ad1 (ad = adanal)
II : 2	ad2
II : 3	ad3

I am retaining my enumeration as having precedence but will use Grandjean's a1 for the bristle of the interlocking triangle. As this notation may be confused with bristles a1 of the notogaster, I prefer to use it in unabbreviated form (anal 1). I had formerly used I : 3 for the posterior bristle, but later (16, pp. 247–248, txt. fig. 2) pointed out that I : 3 really belonged to the lateral row. This necessitated changing the enumeration from I : 3 to II : 3.

I find no reason for studying the mouth parts and legs of the Phthiracarinæ at the *present* time. I do not consider that the specific differences in the *mandibles* are of such systematic value as to warrant spending the necessary time to figure or note them. Their study may have academic value. That is for another generation to determine.

In November 1930 (15) I found that Acarus was a Greek neuter noun and have used it as such. Grandjean has called to my attention that Linné, its original user in systematic literature, used it as a masculine noun as have subsequent writers. As the International Rules of Zoölogical Nomenclature do not cover such usage, I will hereafter follow the usage of Linné.

Types are to be deposited at the Museum of Comparative Zoölogy.

Subfamily Protoplophorinae (15, p. 210)

Phthiracaridæ with more or less distinct transverse segmentation at least in the immature stages, and a long beaklike aspis (10).

Type: Protoplophora (4, p. 217).

Tribe Protoplophorini trib. nov.

Phthiracarinæ with dorsal area of abdomen covered by at least two notogastral plates, the posterior one (pygidium) capable of telescoping under the anterior one (pronotaspis) and usually found in this position in preserved

material; sides covered by freely movable, lateral plates (pleuraspides), as far as now known, one on each side.

Type: Protoplophora (4, p. 217).

Chiefly tropical and subtropical.

Tribe PHTIRACARULINI **trib. nov.**

Protoplophorinæ with pygidium and pleuraspides fused to form an unusually deep and saclike ventral plate.

Type: Phtiracarulus (5, p. 149).

Genus PHTIRACARULUS (5, p. 149)

This is the only genus of Phthiracarulini at present known.

Type: *Phtiracarus* (*Phtiracarulus*) *perexiguus* (5, p. 149).

I regard this as the most highly developed Protoplophorinæ known to date.

Phtiracarulus laevis *sp. nov.*

(Figures 1 to 5)

Diagnositc characters: Pseudostigmatic organ head very slender, long-pointed, smooth; aspis and notogaster with very fine, fairly short bristles.

Description: Size small, length (more or less contracted) 0.28 mm.; greatest length of notogaster 0.23 mm., tip of aspis to anterior edge of pseudostigmata 0.13 mm., thus much smaller than the genotype from Italy; color amber yellow (no red); aspis smooth, produced anteriorly in middle and thus much produced downward, hooklike in lateral aspect, as in the Protoplophorinæ), rim slender, widening slightly posteriad, ventroproximal edge convex, posteroventral corner thickened; pseudostigmata not projecting, exterior portion a simple opening, the organ quite long, slender, sinuous, held lateral (figures 1 and 2), in some individuals a series of very fine cilia may be discerned near distal end; exopseudostigmal bristles very fine, short, to indiscernible.

Notogaster with a fairly deep flange (cloison of Grandjean (13) along anterior edge, and a very deep one along posterior edge (figure 1); with all this unusual development of the flange, the lip (limbe of Grandjean (13) is quite short; anterior edge drawn out in center into a well-developed lobe; with twelve bristles (at least I am unable to discern more): eight dorsal and dorsolateral, and four along upper edge of flange, these four posterior bristles are longer and stouter than the others.

Ventral plate very broadly continuous behind anal aperture (figure 1, not 2). This plate includes the pygidium (metanotaspis) of the Protoplophorinæ. This is evident from two factors, namely, the presence of the six bristles around its posterior end, and the presence of a ridge or suture which, in the tritonymphs, extends between the lowest two of these six bristles and the others (figure 4). This suture represents the border between the ventral plate and the pygidium. The posterior end of this suture is evanescent, incomplete.

In the deutonymphs it is complete around the posterior end and the pygidium is more developed. Thus in this genus one has an actual transition in the fusion of two plates. Actually the ventral plate is made up of the fused pair of pleuraspides of Grandjean (10) which bear two bristles each. The other four bristles are characteristic of the lower edge of the pygidium. Moreover, in the nymphs the notogaster is obliquely truncate, as in the Protoplophorinæ. In the adult this truncation is lost by an extension of the lower edge of the notogaster leaving the two peripheral bristles remote from the ventral edge (compare figures 1 and 4).

Anal covers slender, each with three very fine bristles; anal covers set in a single plate which, in ventral aspect (figure 2), presents an edge view except at anterior end where it appears triangular (each side). Each triangle with two insertions (figure 2). I find no suture or break on the median plane. Genital covers (figure 3) quadrilateral, with a spur at anterolateral corner which fits under ventral plate, anterior edge thickened (figure 2), at least five bristles along mesal edge, two at posterior end of lateral edge, and two near center. It is difficult to account for this three ranked arrangement. In the tritonymphs the median edge of the genital covers is produced anteriad as a spur nearly as long as the body of the covers.

Palp segments similar to leg segments. Legs not unusual; ungues monohamate.

Egg large, reniform, situated at bottom of ventral plate.

Quite similar to *Phthiracarulus rostralis* (23, p. 245, Figs. 8–9) from Guatemala but differs in the following respects: rostral bristles evident; notogastral bristles fewer, the posteroventral much longer, VP1 not discernible; lateral bristles of genital covvers two; posterior bristles of ventral plate reduced to four (each side).

Material examined: Ten specimens from sphagnum moss, bog, Bethany, Conn.; taken June 22, 1932, slide 3220h1. Three hundred ninety-seven specimens from mat of the sedge *Carex trisperma billingsii* of same bog; same date, slides 3221h1, -h2, -h3, and -nh (all *cotypes*). Eight specimens from leaf mould, sphagnum, and mosses from foot of eight inch Tamarack and from under blueberry bushes, Tamarack swamp at foot of Rabbit Hill, town of Warren, Conn.; taken August 26, 1932, slides 3250h7, -h8, -h11, and -h12. Five specimens from deciduous litter (including Rhododendron) from top of Riga Mountain near Bingham Pond (west side of road); taken August 6, 1932, slides 3232h3 and -h4. Ninety-nine specimens from other side of road, on burn of May 4, 1930, slide 3231h1 and -h4. Nine specimens from

decayed spruce stump and blueberry leaf mould and moss, side of Bingham Pond; same date, slide 3233h1. Four specimens from well decayed, fallen hemlock bole, half-way up Sage's Ravine (south side) northeast corner of Connecticut; taken August 17, 1932, slide 3239h2. Twenty-nine specimens from laurel litter, same spot and date, slides 3240h1 to -h3. One specimen from dry hemlock mould with moss, cliffy rocks, same locality and date, slide 3241h3.

Habitat: This species would thus seem to prefer rather wild situations little polluted by man.

Subfamily PHTHIRACARINÆ (15)

Phthiracaridæ with notogaster of adults formed of one plate, immature stages soft, white; aspis never produced ventrad on median line to form a hooklike beak.

Type: Phthiracarus (21, p. 874).

Tribe EUPHTHIRACARINI (15, p. 241)

Phthiracarinæ with ventral plate strongly folded longitudinally each side (bellows-like) very narrow posterior to anus; anal and genital plates or covers very narrow.

Type: Euphthiracarus (9, p. 132).

KEY TO GENERA

1. Anogenital area covered laterally by two long plates (anogenital), mesally by two pairs of slender plates: a genital pair (genital shields) and a very slender anal pair (anal rods) 2
1. Anogenital area covered by only two long plates (anogential) 3
2. Genital shields as broad at anterior as at posterior end; each anogenital plate with four bristles along posterior half; aspal bristles erect; notogastral bristles thirty ..... *Protoribotritia*
2. Anterior end of genital shields much constricted and produced anterodorsad; each anogenital plate with but three bristles along posterior half; aspal bristles prone; notogastral bristles twenty-eight or less ..... *Oribotritia*
3. Aspis small, anterior end depressed; aspal rib short; surface of notogaster stippled to finely scrolled ..... *Pseudotritia*
3. Aspis large, anterior end high, full, rib extending to center of aspis; surface of notogaster sculptured ..... *Euphthiracarus*

Genus PROTORIBOTRITIA gen. nov.

Resembling Oribotritia but with thirty notogastral bristles, four bristles on posterior half of each anogenital plate (paranal), three on each anal rod; aspal bristles erect.

Type: *Protoribotritia canadaris* sp. nov.

Protoribotritia canadaris *sp. nov.*

(Figures 6 to 8)

Size small, diagonal length of notogaster 0.365 mm., breadth and height 0.24 mm., length of aspis 0.2 mm., anterior edge of pseudostigmata to distal end of aspis 0.127 mm.; color pale straw, "stomach" contents pink, amorphous, giving the species a characteristic appearance quite different from any other species known to me; aspis high, without rim, carina, or ridge; pseudostigmata not projecting, merely a small opening internally enlarged and chambered (figures 6 and 8); pseudostigmatic organs well developed, held at right angle to aspis, clavate, head held somewhat erect, distal end constricted much as a lead pencil, with two or three short bristles each side (figure 6); a prominent, internal rib running from pseudostigmata to lower edge of aspis (figure 8); rostral bristles inserted some distance from distal end of aspis, remote! (figure 7), medium long; lateral bristles longer, more approximate (figure 7); vertex bristles very long (figure 8), slightly more remote than rostral (figure 7); collar barely distinguishable; lapet streamlined; bristles a1 distant from anterior edge of notogaster, other bristles disposed as in figures 7 and 8, b1 variable in position; all bristles fine, flexuous; anogenital area as in Oribotritia but anterior end of genital shields not constricted, not produced as a horn anteriad and dorsad (interiorly), each with six bristles inserted some distance from mesal edge of shield; usual two anterior insertions of anogenital plates rather close together, those of posterior half subequally spaced, the bristles as long as notogastral; anterior insertion of anal rods near anterior edge, middle insertion on anterior third, posterior insertion on posterior third (figure 7).

Legs not unusual, tarsi I and II with a long, stout, slightly decurved bristle; ungues monohamate. Palps four segmented, penultimate segment half as long as distal or second, distal segment with distal half much more slender than proximal half, bearing a bristle similar to that of tarsi I and II.

Material examined: One specimen from leaf mould, sphagnum and other moss from foot of eight inch tamarack, and from under blueberry bushes, Tamarack swamp, head of valley at foot of Rabbit Hill, town of Warren, Conn.; taken August 26, 1932, slide 3250h11. One specimen from Rhododendron and oak litter, top of Riga Mountain, near Bingham Pond (east of road), northwestern Conn.; taken August 6, 1932, slide 3232h4. Five specimens from across road on burn of May 4, 1930, slides 3231h1 and -h4. Six specimens from pine leaf-mould and duff, foot of white pines, east slope of Pleasant Hill, Etna, Tompkins Co., N. Y.; taken October 15, 1932, slides 3289n3, 3290h1, 3290h2. Thirty-one specimens from pine leaf mould from base of pine, crest of Con-

necticut Hill, Newfield, Tompkins, Co., N. Y.; taken November 25, 1932, slides 32109h1 and -h2 (*cotypes*).

It is interesting to find this evidently Canadian life zone species in Connecticut but in very small numbers (lot 3250 yielded 713 other Phthiracarids, lot 3232 yielded a total of 101).

Oribotritia banksi (20)

Efforts were made to secure this species along the southern edge of Connecticut but without success. Its northern limit is still Long Island, N. Y.

Genus PSEUDOTRITIA (22, p. 552)

Euphthiracarini with anogenital area covered by only two long plates (anogenital) the median edge of which bears a triangular series of interlocking ridges; aspis small, anterior end depressed; aspal rib short; surface of aspis and notogaster stippled to finely scrolled.

Type: *Tritia* (*Pseudotritia*) *monodactyla* (22, p. 552, fig. 1).

Pseudotritia ardua, (18, fasc. 32/15)
(Figure 10)

This species has already been fully described (15, p. 243, pl. 38, figs. 44–51, pl. 35, fig. 25) and commented on (16, pp. 255 to 258). I now include a figure of the extruded ovipositor (figure 10). In my earlier paper (15) the legend under the specific name (p. 243) should read: figs. 44–51, pl. 35, fig. 25. Bristles anal 1 are present but so short as to be visible only when seen somewhat obliquely, that is they do not project beyond ventral edge of anogenital plate when specimen is viewed in true lateral aspect. These bristles are normally curved backward. In figure 44 (15) my III: 3 of page 245 (as pointed out by Grandjean (13) is the opening to the abdomino-lateral gland, the bristle below it is III: 3. The abdomen may be so compressed that the dorsal and posterior faces form a sharp angle (like a gable roof), or it may be so broad as to form a rounded dorsal and posterior face. These differences in degree of compression may be sexual.

In its various forms but chiefly as the typical form I have it from lots as follows and as presented in the Table of Occurrences at the end of this paper.

Material examined: Three specimens from epigeous moss clumps, in thicket, edge of swampy woods, East Village, Monroe, Conn.; taken January 18 (a week after a fifteen degree freeze) 1932, slide 322h. One specimen from leaf litter, woodland slope, East Village, Monroe, Conn.; taken March 31, 1932, slide 328nh. Four specimens (two with pock-marks on the *inner* face of the notogaster!) from hickory shag from base of bole of a hickory in vacant lot on Coscob headland, Conn.; taken April 12, 1932, slide 3212h. Three specimens from well decayed stump of white cedar, epigeous moss and litter from small white cedars, Bethany bog, Conn.; taken June 22, 1932, slide 3223h. Three specimens from oak leaf litter and duff, sandy ridge northeast of North Haven, Conn.; taken September 14th (dried the 23rd), slide 3267h. Three specimens from same spot but almost exclusively leaf mould, slide 3270h2. One specimen from decayed oak branches lying on ground, same spot as last; dried September 28, slide 3271h. Thirty specimens from ericaceous leaf mould among pines, sand barrens between North Haven and Northford (charred leaf mould common); dried September 29, slides 3272h and 3273h. Twelve specimens from scrub-oak litter from base of sprout clump, same locality; dried October 6, slides 3276h and 3277h. One specimen from lower, mucky layer of sphagnum, below the frozen layer, in swale, below road below wooded ridge of Connecticut Hill, Newfield, Tompkins Co., N. Y.; taken November 25, 1932, slide 32107h. Three specimens from trash, Columbia, Mo., taken by C. R. Crosby, in Cornell Univ. Coll., determined by Ewing as *Phthiracarus americanus* (as well as an accompanying *Euphthiracarus flavus*).

From the collection of August E. Miller, I have before me a flower-bed marker of white pine which had been treated with corn syrup solution by boiling for one hour. This stake was then exposed outdoors to termites and became infested with *Pseudotritia ardua* which had eaten into the stake. It was then sealed into a glass tube by Dr. Miller. When I examined the stake, it was riddled with the galleries of this mite, the bodies of the adults being on the surface of the wood and in the ends of the burrows. Moreover, the surface of the stake was heavily coated with the fæces and frass of the mites. Thus it is evident that this species

will readily eat out wood, especially if impregnated with food. It is possible that the mites were attracted by fungi which may have developed on the syrup rather than by the syrup itself. The stake had not been rendered punky by fungus digestion. At any rate this is experimental evidence that these mites are the termites of the northern woods.

Thus this species is again seen to be common under most conditions but not in extremely wet situations as sphagnum of an open bog (but see 32107, and another in the overlying frozen layer (not otherwise recorded, slide 32106o1). It is of particular note that it is almost the only Phthiracarid secured in the pine-oak sand barrens between North Haven and Northford (the exceptions being *Pseudotritia simplex* and *Phthiracarus setosus*).

Pseudotritia ardua curticephala *subsp. nov.*

Pseudostigmatic organ head short, truncate with about eight fairly long, stiff bristles directed distad (rather than laterally); rib which, in the species passes along ventral edge of pseudostigmata (15, pl. 38, fig. 44), is here broken below the pseudostigmata, so that the anterior half abuts against front edge of pseudostigmata while the posterior half passes ventrad beyond the pseudostigmata; vertex bristles nearly as short as lateral, truncate; sculpture of aspis and notogaster coarsely scrolled (vermiculate); center of aspis and anogenital plate somewhat pocked; anterior half of anogenital plate with a low longitudinal ridge near its center (visible only in ventral aspect), bristle of interlocking triangle longer, plainly visible in lateral aspect, an additional insertion on mesal edge of anogenital plate just beyond triangle; two bristles on rim of anogenital plate subequal to or slightly longer than the others; size not large, diagonal length of notogaster 0.4 mm., height of notogaster 0.25 mm., end of aspis to anterior edge of pseudostigmata 0.16 mm.

Material examined is entered on Record of Occurrences. The forty cotypes are on slide 3239h1. It is interesting to note that this evidently Canadian life zone form is in some cases found in the same lot with the species, being easily distinguished by the much smaller size. This and the difference in the trussing of the lower edge of the aspis lead me to wonder if it is not a full species. More distributional data is needed to settle this point.

Pseudotritia simplex (15, p. 248)

Aspis with a low ridge, much as in *Pseudotritia ardua;* rim slender, terminating at distal end of carina; rostral bristles short,

very fine, close together, inserted at distal end of ridge, lateral bristles more anterior than usual, only slightly more remote than rostral!; vertex bristles remote, not distant from pseudostigmata which are reduced externally to a simple opening; pseudostigmatic organ head with blunt distal end.

Notogaster with short, very fine bristles. Compared to *Pseudotritia ardua* these bristles have migrated forward so as to be unusually concentrated about dorso-lateral areas. Anogenital plates as in *Pseudotritia ardua* but bristles of both genital and anal areas reduced to four. Of these the last two of anal area are much longer and correspondingly stouter. These two long bristles are inserted anteriad and posteriad of transverse plane of VP2. It is therefore difficult to say what bristles they represent. In Euphthiracarus the peripheral bristles (I:1 and I:2) are much longer than the others while in *Pseudotritia ardua* they are shorter.

The eggs are fairly closely armed with prominent decurved spines, giving it a very burry appearance. I have not noticed more than three per female at one time.

Material examined in addition to the material recorded on Record of Occurrences: Thirty specimens from sphagnum moss, open bog, Bethany, Conn.; taken June 22, 1932, slide 3220h1. Forty-six specimens from mat of the sedge *Carex trisperma billingsii*, same bog, same date, slide 3221h1, -h2, -h3 and -h4. Thirty-five specimens from well decayed stump of white cedar, epigeous moss, and litter of small white cedars, same bog and date, slide 3223h. Twelve specimens from coarsely foliose and fruticose lichens and Selaginella covering large boulders and ledges, short way up south side of Sage's ravine, northwest Conn.; taken August 6, dried August 16, 1932, slide 3238h1. One specimen from oak leaf litter and duff, sand ridge northeast of North Haven, Conn.; taken September 14, dried the 23rd, slide 3267h. One hundred fifty specimens from same spot as preceding lot but almost exclusively duff, dried September 26, slides 3269h1 to -h5. Fourteen specimens from same spot as lot 3267 but almost exclusively leaf litter, dried September 27, slide 3270h1. Nine specimens from scrub oak litter from base of sprout clump, sand barrens between North Haven and Northford, Conn.; taken September 14, dried October 6, slides 3276h, 3277h.

From these records this species seems to be tolerant of a great variety of conditions.

Genus EUPHTHIRACARUS (9, p. 132)

Euphthiracarini with anogenital area covered by only two long plates (anogenital); aspis large, anterior end high, full, rib extending to center of aspis; pseudostigmata with shelf along lower edge; surface of notogaster, as well as of aspis and anogenital plates, sculptured.

Type: *Phthiracarus flavus* (7, p. 450, Fig. 1).

KEY TO SPECIES

1. Pseudostigmatic organs with broad head 2
1. Pseudostigmatic organs bristlelike, ciliate 4
2. Sides and top of aspis pocked; notogastral bristles short, stout, stiff. *E. crassisetæ*
2. Sides of aspis smooth; notogastral bristles fine, flexuous 3
3. Anterior end of aspis depressed, flattish, much as in Pseudotritia, carina double as in Euphthiracarus; rib fine, faint; rostral bristles porect, gently curved; the four bristles of posterior end of anogential plates subequally spaced, the posterior one (II: 3) at least as long as notogastral bristles I: 5; II: 1 much nearer I: 1 than to anal 1. ..... *E. depressculus*
3. Anterior end of aspis high, angular; carina simple, as in Pseudotritia; rib well developed; rostral bristles with distal half bent; the four bristles of posterior end of anogenital plates with posterior one more distant and shorter than notogastral bristles I: 5; II: 1 distant from I: 1, midway between I: 1 and anal 1. ..... *E. punctulatus*
4. Dorsal face of aspis pocked; pseudostigmatic organs bristlelike, bilaterally ciliate; notogaster high ..... *E. flavus*
4. Pocking confined to distal end of aspis; pseudostigmatic organs with distal third slightly swollen, cilia two ranked but on the same side; notogaster of usual height ..... *E. flavus pulchrus*

Euphthiracarus depressculus (14, p. 90, Figs. 1–6)

This species is related to Pseudotritia in the shape of the aspis and diminutive rib, but the double carina and sculpturing relate it to Euphthiracarus. The pseudostigmata moreover have shelf along ventral edge, and anogenital plate bristles a1 are long.

Material examined: One specimen from dry hemlock mould, moss and Selaginella of cliffy rocks, south side of Sage's Ravine, northwestern Conn.; taken August 23, 1932, slide 3241h1. Three specimens from inner layers of well decayed hemlock branch,

lying in pine-hemlock gully, east side of Pleasant Hill, Etna, N. Y.; taken November 3, 1932, slides 32100h and 32101h. One specimen from lower mucky layer of sphagnum (below the frozen layer) about tree stump, in swale below road below wooded ridge of Connecticut Hill, Newfield, Tompkins Co., N. Y.; taken November 25, 1932, slide 32107h. One specimen from epigeous moss, and lichens from old wood and stumps, woods, crest of Connecticut Hill; same date, slide 32110h. One specimen from moss from rock rim at foot of slope, south side of Taughannock Ravine, Cayuga Lake, N. Y.; taken April 25, 1932, slide 336h1. One specimen from fallen dead wood, beech woods on road 330, north Brookdale (Six Mile valley, south of Ithaca), N. Y.; taken August 20, 1933, slide 3321h.

Except for the Connecticut record, known only from vicinity of the type locality especially places showing Canadian life zone tendencies. Distinctly epixylous.

Euphthiracarus punctulatus (15, p. 250, pl. 40, Figs. 60–65)

This species is related to Pseudotritia by its simple carina, and not broadly rounded rostrum; the rostral bristles are not as curved and depressed as in the type species. It is intermediate in shape of aspis and rostral bristles between the above species and the next.

Material examined: One specimen from rot-pocket in section of trunk of yellow birch, cut about two years previously, near East Village, Monroe, Conn.; taken November 6, 1931, slide 3175h. Twenty-seven specimens from under face of old boards, edge of woods, near East Village; taken August 4, 1932, slide 3230h. One specimen from very rotten log in woods, near East Village; taken August 25, 1932, slide 3245h. Eleven specimens from under face of wood, woodland margin, foot of Indian Hill, along Forest Road, New Haven, Conn.; taken August 25, 1932, slide 3247h. One specimen from leaf mould, small gully on road up from Cayuga Lake between Myers and Norton, N. Y.; taken December 5, 1932, by C. R. Crosby, slide 32111h. One specimen from leaf mould, from under ground hemlock and foot of an elm, on slope, eight feet above ravine bottom, south side of Taughannock Ravine, N. Y.; taken April 25, 1933, slide 337h1.

This extension of range into central New York is complementary to the preceding. It begins to look as if this species were transitional and the preceding were Canadian. Both are predominantly epixylous.

Euphthiracarus flavus pulchrus (15, p. 250, pl. 39, Fig. 59)

Based on a single specimen from a hemlock ravine in central Connecticut, this species now appears to be fairly common in rather dry habitats in unanthropized areas of the northwest corner of the state (see Record of Occurrences).

Euphthiracarus crassisetæ *sp. nov.*

Diagnostic characters: Bristles somewhat short, stout; rostrum high; dorsal face of aspis entirely pocked, down to the usual double carina; rostral bristles short, stiff; vertex bristles long, slightly clavate; pseudostigmatic organs long (in dorsal aspect), curved anteriad and dorsad, with short, clavate head, each edge lined with cilia, thus somewhat resembling those of *Pseudotritia ardua* but distal end more blunt; anterior end of anogenital plates flattened, finely crenulate, bristles II: 2 inserted on transverse plane passing close to I: 2.

Description: Aspis typical for the genus; rib slender but well developed; rim extended to base of rostrum; notogaster amygdaloid, similar in shape to that of *Pseudotritia ardua,* sculptured with pock marks leaving interspaces narrower than the pocks. Grimy individuals have the pocks filled with grit so that the pocks are no longer visible but one sees clusters of granules with interspaces wider than the granule clusters, sculpture extending to edges; dorsal edge of collar somewhat recurved; bristles inserted as usual for the genus; anogenital plates pocked, the three anterior bristles of the genital area concentrated on the flat, finely crenulated area; bristles of anal area inserted much as in *E. flavus* but I: 1 and I: 2 more distant.

Dimensions:	*Male*	*Females*
Greatest l. of notogaster	0.459 mm.	0.578 mm.
Height of notogaster	0.28 mm.	0.34 mm.
Total length of aspis	0.178 mm.	0.28 mm.
Anterior edge of pseudostigmata to tip of rostrum	0.14 mm.	0.2 mm.

Cotypes: Four specimens from leaf mould from beneath ground hemlock and foot of an elm, eight feet above ravine bottom, south slope of Taughannock Ravine, N. Y.; taken April 25th, 1933, slide 337hl.

Tribe PHTHIRACARINI (15, p. 214)

Phthiracarinæ with ventral plate bowed ventrad, not at all infolded, broad behind anal aperture; anal and genital covers quite

horizontal, or convex, more or less quadrangular, always free from each other, usually with contiguous corners modified in the form of interlocking nubbins, adjacent edges also warped and curved so as to complement; anterior edge of genital covers deeply infolded to form a collar, or enclosing a collarlike accessory plate. For further description see 16, p. 238.

Type: Phthiracarus (21, p. 874).

Key to Genera

1. Anal covers quite flat (often completely retracted into body), their median edge bearing two well spaced bristles 2
1. Anal covers strongly convex, thus prominently protruding beyond ventral plate, and bearing at least three closely spaced bristles along median edge 3
2. Vertex bristles prominent, erect ..... *Hoplophthiracarus*
2. Vertex bristles invisible or lying close to surface of aspis ..... *Phthiracarus*
3. Anal covers with three closely and subequally spaced bristles along median edge ..... *Hoplophorella*
3. Anal covers with four closely and subequally spaced bristles along median edge ..... *Steganacarus*

Genus Hoplophthiracarus (16, p. 239)

Phthiracarini with anal covers quite flat, their median edge bearing two well spaced bristles (I:1 and I:2); vertex bristles prominent, erect.

Type: *Hoploderma histricinum* (3, p. 12, also 16, p. 240, pl. 20, figs. 14 and 15).

Hoplophthiracarus paludis *sp. nov.*

(Figure 10)

Diagnostic characters: Aspis with retracted rim, carina distinct, firm; bristles stout, gradually tapering to a point; notogastral bristles a1 on edge of collar; anal cover bristles II: 2 long, distal end curved backward.

Description: Aspis smoothly rounded in both lateral and dorsal aspects; rostrum in lateral aspect, with rounded blunt end, and constricted, extremely slender rim; rostral bristles short, straight; lateral bristles absent; vertex bristles quite long, curved; pseudostigmata with well-developed dorsal rim, organ clavate, the head strongly bent upward, (figure 10), abruptly and bluntly pointed.

Notogaster rather low, posterior end flattish; collar narrow, lapet poorly developed; bristles a3 on edge of collar, sometimes directed forwards, a1 rather approximate (figure 10); ventral plate bristles on suture; genital covers each with four distinct, subequally spaced bristles, the anterior two insertions with-

out apparent bristles; anterior edge projecting, rounded; anal covers much longer (figure 10); bristles II: 2 inserted on transverse plane passing slightly nearer I: 2 than I: 1; II: 3 in line with I: 1 and I: 2.

Dimensions of a large individual: diagonal length of notogaster 0.42 mm., height of notogaster 0.28 mm., total length of aspis 0.2 mm., anterior edge of pseudostigmata to anterior end of aspis 0.123 mm.

In general aspect, this species most closely resembles *H. grossamni* (16, p. 243, pl. 20, figs. 12 and 13). The only specialized feature is the position of anal cover bristles II: 3.

Material examined: Thirty-seven specimens from sphagnum moss, open bog, Bethany, Conn.; taken June 22, 1932, slides 3220h1 and -h2. Six specimens from grass (or sedge) mat of open bog, same locality and date, slide 3221h4. Fourteen specimens from well decayed white cedar stump, epigeous moss and litter, under young cedars, edge of same bog, same date, slide 3223h. Six specimens from sphagnum moss and sedge from edge of Bingham Pond, Riga Mountain, northwestern Conn.; taken August 6, 1932, slide 3234h1. Twenty-three specimens from sphagnum of open bog, McClean, Tompkins Co., N. Y.; taken October 24, by Norman Davis, slides 3291h and 3294h (cotypes).

Genus PHTHIRACARUS (21, p. 874)

Phthiracarini with the two posterior pairs of aspal bristles prone and usually not discernible; anal covers not conspicuously convex, the bristles disposed in two rows; surface not pocked or coarsely sculptured. For further details see 16, p. 244.

Type: *Phthiracarus contractilis* (21, p. 874.).

The term Hoploderma (19, p. 77) was instituted to supplant the preoccupied name Hoplophora (17, p. 116) and thus by International Rules of Zoölogical Nomenclature takes the same type: *H. lævigata* which is synonymous with the type of Phthiracarus. German acarologists use the term for pitted or rough species with *H. lævigata* (meaning smooth) as type!

KEY TO SPECIES

1. Notogastral bristles longer than anal cover 2
1. Notogastral bristles shorter than anal cover 4
2. Five bristles on mesal rows (not including VP3) 3
2. Six bristles on mesal rows ..... *Ph. setosus*
3. Aspis with projecting rim; pseudostigmatic organs short ..... *Ph. bryobius*

3. Aspis with no projecting rim; pseudostigmatic organs long. *Ph. boresetosus*
4. Pseudostigmatic organs long; notogastral bristles stout, not gradually tapering to a fine point, six in mesal rows ..... *Ph. olivaceus*
4. Pseudostigmatic organs short 5
5. Rostrum projecting beyond rim of aspis 6
5. Rostrum not projecting beyond aspal rim 7
6. Bristles medium long ..... *Ph. compressus*
6. Bristles very short and fine ..... *Ph. brevisetæ*
7. Rim formed of reflexed edge of aspis; pseudostigmatic organs blunt. *Ph. anonymus*
7. Rim formed of thickened edge; pseudostigmatic organs pointed 8
8. Anterior end of aspis high, angular; notogastral bristles a1 distant from collar ..... *Ph. sphaerulus*
8. Anterior end of aspis low, rounded; notogastral bristles a1 on edge of collar ..... *Ph. setosellus*

This key does not include *Phthiracarus sarahæ* and *Phth. erinaceus* (see key of 15, p. 235) which were secured from, and are still known only from, Cliff Island, Casco Bay, Maine.

Phthiracarus boresetosus (15, p. 228)

(Figures 15 to 17)

Emended description: I now present figures for this species, and the following additional characteristics: Rostral bristles inserted rather high up, fairly long, strongly curved (figure 15); rostrum without rim; ventral plate without denticles; VP3 not external; genital covers with but three bristle insertions in outer row (figure 16); accessory plate with a short, blunt horn (figure 15); anal cover bristles II: 2 inserted just anterior to transverse plane passing through I: 2; II: 3 not in line with I: 1 and I: 2 (figure 16).

The pseudostigmatic organ is unique for this tribe (figure 17). I regard it as a primitive form, much resembling a bristle (see also that of Phtiracarulus, and other Protoplophorinæ). The lack of rostral rim and of carina are primitive characters; the presence of accessory plate horn ally it to *Phthiracarus compressus* and *Phth. bryobius.* It is specialized only as to length of bristles, so I consider this species the most primitive of our Phthiracarus.

Material examined in addition to that recorded in the Table of Occurrences: I have two specimens recorded by Ewing as *H. lurida,* from leaf mould from gorge near Lake Keuka, N. Y.;

taken October 30, 1910, by C. R. Crosby, Cornell Univ., coll. lot 370 sub 4.

All these records are from localities in the Canadian life zone or bordering thereon, and chiefly from leaf mould though also occasionally from moss.

Phthiracarus anonymus amicus *subsp. nov.*
(Figures 11 to 13)

Differs from the species in that bristles b2 are closer to b1 than to c1; anal cover bristles II: 1, I: 1 and I: 2 only visible, each considerably longer than the preceding so that I: 2 is much longer than in the species (12) (figure 13). Dimensions of a large individual: diagonal length of notogaster 0.4 mm., height of notogaster 0.26 mm., total length of aspis 0.22 mm., anterior edge of pseudostigmata to anterior end of aspis 0.12 mm.

Specific characters: Rim projecting prominently, formed of the flaring edge of the aspis, not thickened (figure 11); carina distinct but faint; pseudostigmatic organs short, blunt; notogastral bristles a1 on collar; anal covers with posterior half concave in lateral aspect; ventral plate without denticles; accessory plate with horn (figure 12).

Cotypes: Six specimens from deciduous leaf mould, woods, crest of Connecticut Hill, Newfield, Tompkins Co., N. Y., November 25, 1932, slides 32108h2 and -h3.

It is extremely strange, bewildering, to find a species described from, and thus far known only from, the Pyrenes, in the Canadian life zone of New York state. It is also related to the commonest species of northern Europe, *Phthiracarus ferrugineus* (17, figures 26–33).

Phthiracarus compressus (15, p. 232, pl. 36, Figs. 26–29)
(Figure 14)

This species might be mistaken for *Phthiracarus setosellus.* It differs in having the following characteristics: pseudostigmatic organ head usually blunt; aspal carina absent; aspal rim contracted (rostrum projecting beyond it); notogastral bristles a1 distant from collar.

It may also be confused with small specimens of *Phthiracarus sphaerulus* from which it differs in having pseudostigmatic organ head usually blunt; no carina; anterior end of aspis lower, more rounded.

An interesting differential character, heretofore overlooked

is a spoonlike or hornlike process on mesal end of accessory plate of genital covers (figure 12). It is very much more developed in a European species. It is not visible in some aspects or conditions of closure.

I have two specimens from lot 3240 which seem to be hybrids of this species and *Phthiracarus setosellus*. The aspal rim and pseudostigmatic organs are those of *Phth. setosellus* but the bristles are those of this species. Moreover the accessory plate bears the spoonlike process.

The exact shape of the pseudostigmatic organs varies considerably, so I have included a series of free-hand sketches from specimens of one lot (3226h1). Figures above numeral 14 are lateral aspects, figures below it are dorsal aspects. The notogastral bristles may be considerably longer than originally figured.

Material examined in addition to the material recorded in the Table of Occurrences: Two specimens from leaf humus of tussock sedge, alder thicket next to the railroad tracks, North Haven, Conn.; taken September 14, 1932, slide 3262h. Two specimens from leaf and twig litter, and moss from base of alder clumps, same date and locality as last, slide 3263h. Two specimens from pine leaf mould, foot of pine, woods, Pleasant Hill, Etna, N. Y.; taken November 2 (snow on ground), slide 32103h.

It now appears that, although most commonly associated with moss, this species is also to be found on decayed wood and, of course, in leaf litter. The present records show it to extend from the Austral into the Canadian life zones.

Phthiracarus bryobius (15, p. 232, pl. 34, Fig. 19)

(Figures 18 to 21)

Emended description: The color varies from greenish-grey to olive-brown; the length of the bristles varies considerably, the condition originally figured is average; the size also varies a great deal even in the same lot: diagonal length of notogaster 0.42–0.53 mm., height of notogaster 0.26–0.32 mm., breadth of notogaster 0.23 mm., length of aspis 0.21–0.26 mm., anterior edge of pseudostigmata to distal end of aspis 0.11–0.15 mm.; pseudostigmatic organs rather short, distal end rounded, narrower than body of organ (figures 18 to 20); notogastral bristles a1 more approxi-

mate than bl or cl; ventral plate without denticles but with a shallow notch!; anal covers quite long, all five bristles well developed (figures 18 and 21), II:2 on transverse plane of I:1 or very nearly; accessory plate with spoonlike process, much as in *Phthiracarus compressus.*

This species is therefore easily recognized by its very long, fine bristles; long, low, narrow notogaster; short pseudostigmatic organs; faint carina; high, smoothly arched aspis; and horned accessory plate. It is therefore more closely related to *Phthiracarus compressus* than to *Phthiracarus setosellus.*

Material examined in addition to that recorded in the Table of Occurrences: One specimen from drifted oak and maple leaves, dry upland woods, East Village, Monroe, Conn.; taken June 19, 1926, slide 2610o1. One specimen from club moss under snow, upland swamp, same locality; taken February 18, 1922, slide 22ao1. Six specimens from inner layers of well decayed, fallen hemlock branch, hemlock-pine gully, Pleasant Hill, Etna, N. Y.; taken November 3, 1932, slide 32100h.

From these records it is evident that this species is epixylous.

Phthiracarus setosellus (15, p. 231, pl. 33, Fig. 7; pl. 35, Figs. 20–24)

Material examined in addition to that recorded in the Table of Occurrences: Three specimens from bark of ironwood (*Ostrya virginiana*), scraped from an area twelve inches long, four to five feet from the ground, live tree growing in upland swamp woods near East Village, Monroe, Conn.; taken February 13, 1932, slide 326. Two specimens from hickory shag, from base of a healthy, standing tree, in vacant lot, Coscob headland, Conn.; taken April 12, 1932, slide 3212h.

Never as common as *Phthiracarus compressus* this species is found in similar habitats except that it shows a preference for decayed wood. The two records of the preceding paragraph are unusual as it makes the species at least partly arboreal. For hybrids with *Phthiracarus compressus* see under that species. This species is rather closely related to the common European *Phthiracarus ferrugineus* (17, figures 26–33).

Phthiracarus sphaerulus (1; 15, p. 233, pl. 33, Figs. 1–5)

Material examined in addition to that recorded in the Table of Occurrences: One specimen from leaf litter, woodland slope, near East Village, Monroe, Conn.; taken March 31, 1932, slide 328h. Two specimens from leaf mould from gorge near Lake Keuka, N. Y.; taken October 30, 1910, by C. R. Crosby, Cornell Univ. Coll. lot 370 sub 3 (determined as *Hoploderma dasypus* by Ewing). One specimen from under a log, Xenia, Ohio; taken September 14, 1910, by H. E. Ewing.

This strongly epixylous species is also found in Florida (16, p. 245).

Phthiracarus brevisetae (15, p. 225, pl. 33, Fig. 6)

One specimen from ground hemlock litter, south side, lower end of Taughannock Ravine, Cayuga Lake, N. Y.; taken May 27, 1933, slide 3312h2.

Phthiracarus olivaceus (15, p. 228, pl. 34, Figs. 13–18)

Material examined in addition to that presented in Table of Occurrences: Twenty-three specimens from under face of old boards, edge of woods, East Village, Monroe, Conn.; taken August 4, 1932, slide 3230h.

Though this very distinctive species barely extends into the Canadian life zone it is found throughout the Transitional, on decayed wood, and consequently in the litter, and even occasionally in epigeous moss.

Phthiracarus setosus (1, p. 16) (15, p. 226, pl. 34, Figs. 8–12; pl. 36, Fig. 30)

Material examined in addition to that recorded in the Table of Occurrences: One specimen from oak duff, sand ridge northeast of North Haven, Conn.; taken September 20, 1932, slide 3269h2.

This very distinct species, found in only five lots, is even more restricted northward to the Transitional life zone. Its occurrence in Taughannock Ravine, central New York is a surprise.

Genus HOPLOPHORELLA (6, p. 260)

Phthiracarini with coarsely sculptured notogaster; anal covers strongly convex at least mesally, and with only three bristles along median edge.

Type: *H. cucullatum* (8, p. 133, pl. 6, fig. 35).

Hoplophorella thoreaui (15, p. 239, pl. 37, Figs. 40–43)

Material examined: One specimen from sphagnum from Barnum Pond, Franklin Co., N. Y.; taken June 13, 1933, by C. R. Crosby, slide 3331n. One specimen from decayed spruce stump wood (and covering lichen), or moss and lichen of blueberry hummock, side of Bingham Pond, Riga Mountain, northwestern Conn.; taken August 6, 1932, slide 3233h2. Four specimens from sphagnum moss and sedge, edge of same pond, slide 3234h1. Ten specimens from blueberry leaf mould, same locality and date, slide 3235h2, and -h3. One specimen from Rhododendron and oak litter, dry woods, on burn of May 4, 1930, near Bingham Pond; taken August 6, 1932, slide 3231h2.

Genus STEGANACARUS (9, p. 130)

Phthiracarini with coarsely sculptured notogaster; anal covers strongly convex at least mesally, but with four bristles along median edge.

Type: *H. anomala* (2, fasc. 6:5).

Steganacarus striculus diaphanus (15, p. 236, pl. 37, Figs. 33–39)

This is a very variable species in respect to size, development of aspal ridge, shape of rostral bristles which may be nearly straight to strongly curved or even bent, and position of notogastral bristles a1 which may be on edge of collar to half length of bristle behind it. Although specimens from southern Connecticut seemed constant in these characteristics, specimens from the northwestern corner of that state show considerable variation, and I fail to find correlations between any two characters. Specimens from the type locality of the species (Regensburg, Germany) are constant in having slightly curved rostral bristles and

notogastral bristles a1 inserted on edge of collar. Specimens from Strasbourg have rostral bristles sharply bent and held close to face of rostrum, and notogastral bristles a1 distant from collar. The rostrum is quite high. Thus there seem to be distinct subspecies in Europe. It may be that specimens from typically Canadian localities will show constancy of these characteristics, and that my northern localities are in a tension zone. Some specimens from Taughannock Ravine, central New York state, have the anal cover bristles with a wide space between bristles 1 and 2 (slide 337h1).

Material examined in addition to that recorded in the Table of Occurrences: Seventeen specimens from coarsely foliose to fruticose lichens and Selaginella growing on large boulders and ledges, a short way up south side of Sage's Ravine, northwestern Conn.; taken August 6 (dried August 16), 1932, slide 3238h1. One specimen from sphagnum of bog, McClean, N. Y.; taken October 24, 1932, by Norman Davis, slide 3291h. Seven specimens from moss from foot of tree on south slope of gully, Pleasant Hill, Etna, N. Y.; taken November 3, 1932, slide 32102h. Twenty-five specimens from pine leaf mould of preceding spot and date, slide 32103h. Two specimens from lower, mucky layer of sphagnum (below the upper frozen layer), swale below road below wooded ridge of Connecticut Hill, Newfield, Tompkins Co., N. Y.; taken November 25, 1932, slide 32107h. Sixty-eight specimens from pine leaf mould from base of tree, wooded crest of Connecticut Hill, same date, slide 32109h1 and -h2. Two specimens from epigeous moss and lichens from old wood and stumps, same locality and date as last, slide 32110anh.

Judging from these numerous records this species is most at home in resinous leaf mould. It may be that the eggs are laid inside the leaves and the immature animals eat them out.

Retrospect

Phthiracarus brevisetae, known from but two specimens from two collections in Connecticut (15, p. 225), was not again secured in that state but one specimen turned up from central New York. This species is the enigma of the group. In the state of Connecticut, where most of the collecting has been done, there are eighteen

species and one subspecies. It is possible that *Oribotritia banksi* may yet be found along the southern edge of the state in warm pockets, possibly at the eastern end. The new material shows how restricted are some species of this group. For instance *Hoplophthiracarus paludis* was obtained only from sphagnum bogs (in New York and Connecticut). In southern Connecticut *Phtiracarulus leavis* was found only in a sphagnum bog, though more generally in the northern part of the state.

Five or six species per quart of litter are quite normal. Seven species were secured from deciduous (32108), Rhododendron-oak (3240), blueberry (3255), pine (3257), and ground-hemlock (*Taxus canadensis*) (337) litters, as well as moss (3237, 3234), eight species from another lot of Rhododendron-oak (3232) and ground-hemlock (3312) litters, and nine species from hemlock litter (3236). Although eleven species were secured from one lot (3250) the material included leaf-mould from under a Tamarack and its neighboring blueberry bush as well as epigeous moss and sphagnum from between the two (in a Tamarack swamp). The lot may have included more than a quart of litter but all the material came from an area of nine linear feet. The species making up these lots vary locally. One cause for this variation may be the presence or absence of a well-decayed twig or bit of wood.

Of further interest are the three species associated in sphagnum moss of open bogs (*Phtiracarulus laevis, Pseudotritia simplex* and *Hoplophthiracarus paludis* (3220). The same three species were found in pure growths of *Carex trisperma billingsii* of the same bog (3221). This combination was not found in sphagnum of a New York bog (3291). In fact *Phtiracarulus laevis* was not found in central New York though *Pseudotritia simplex* was found in small numbers.

There is reason to believe that latitude tends to cause changes in habits or habitats in the same species. In my work on the Galumninae, I have already pointed out that the same species (usually different subspecies) has entirely different habitat preference in Europe than in North America. Another distributional observation is that some of the Oribatoidea are very local, so that lots can be taken from many spots in the same locality before all the species are obtained.

The young of any of these species are rarely found by the usual collecting method. This is undoubtedly due to their being situated inside of decayed wood or other plant tissues from which they cannot emerge without suffering immediate desiccation. Moreover their legs are not developed for perambulation. I am therefore certain that the determination of the niches of the young will prove of much greater ecologic interest than that of the adults which may wander widely in search of mates. After surveying the distribution records of this and the preceding report (15), I am satisfied that most of the adults are generally distributed over the forest floor but they are numerous where the preferred food of the immatures is abundant.

It is of particular interest that although one or two species of Galumninae have been introduced from Europe to the neighborhood of some of our cities, as far as known no Phthiracaridae have been so introduced—unless *Pseudotritia ardua* be so regarded, though I consider it a holarctic species too variable to establish clean cut geographic races.

The small, pale colored *Steganacarus striculus diaphanus* is found in the greatest numbers and most generally. *Pseudotritia ardua* and *Pseudotritia simplex* are the most resistant to desiccation and consequently found in the driest habitats, as sand barrens, vegetated sandy beaches, on frequently burned land, and on cultivated land, while other species of the family are absent. This difference may be due to one habit, namely, laying eggs in the soil or in decayed roots. If species of Phthiracarus lay their eggs in dead leaves or dead wood above ground, the eggs would be killed by the next fire and both adults and immatures would be eliminated from the area of the fire, while the eggs and young of the Pseudotritias, safe in the cool, moist soil would be unaffected by the litter consuming fire. Species inhabiting dead wood will survive if the fire is swift enough or dead wood is wet enough to remain unburned. I have found such partly burned sticks on burned woodlands, and with a fauna thereon. A comparison of lots 3231 and 3232 shows that a fauna becomes rapidly established two years after a fire. It is possible, however, that the spot from which I secured the samples was near enough to the road to have become moistened by the fire-fighters.

RECORD OF OCCURRENCES

	Ps. ardua	*Ps. a. curticephala*	*Ps. simplex*	*Eu. f. pulchrus*	*Ph. compressus*	*Ph. bryobius*	*Ph. setosellus*	*Ph. sphaerulus*	*Ph. boresetosus*	*Ph. olivaceus*	*Ph. setosus*	*S. diaphanus*
Connecticut												
3247 Under face of wood, wood margin, foot of "Indian Hill", along Forest Rd., New Haven, Conn., Aug. 25, 1932					2			1		1		
3226 *Selaginella apus* and epigeous moss of upland swamp, especially from the more elevated clumps of earth, among skunk cabbages, East Village, Monroe, Conn., July 7	30				30		3				3	2
3229 Old fence rails branches, and chips, old orchard, East Village; Aug. 4.	5					1	1	14		22		
3245 Very rotten log in mesic hardwoods, East Village, Aug. 25 *			7		3		1	1				4
3250 Leaf mould, sphagnun and other mosses about foot of an eight inch Tamarack and under blueberry bushes of a Tamarack swamp, head of valley at foot of Rabbit Hill, Warren, Conn. Aug. 26*	42		70		46		1	10	10	1	83	442
3252 Pine leaf mould of fernery, north side of Howland Mt., roadside, South Cornwall, Conn., elev. 1300ft. Aug. 26	1						1		11	1		12

RECORD OF OCCURRENCES *(Continued)*

	Ps. ardua	*Ps. a. curticephala*	*Ps. simplex*	*Eu. f. pulchrus*	*Ph. compressus*	*Ph. bryobius*	*Ph. setosellus*	*Ph. sphaerulus*	*Ph. boresetosus*	*Ph. olivaceus*	*Ph. setosus*	*S. diaphanus*
Connecticut												
3253 Moss on rocks along trickle (possibly also rotten roots, etc.), Calhown Pines, Cornwall, Conn., Aug. 26			1		48	2	6		60			80
3254 Epilithic moss (possibly old wood also), top of slope, same loc. and date.			3			6		3	6			90
3255 Well decayed fallen boles and their moss, same loc. and date		14	1		4					1		26
3257, 3259 Pine leaf mould (no moss), same loc., dried Sept. 6		6	169	2	9				22	1		274+
3236 Hemlock leaf mould up Wachocastinook Creek, (below burn), dried Aug. 13	9	1		3	8		10	5	6	1		403
3237 as 3236 but epigeous moss and old stump moss under Rhododendron, dried Aug. 15	7	2		2	2		2	7			1	24
3232 Rhododendron and oak litter, dry woods, near Bingham Pond, Riga Mt., northwestern Conn. Aug. 6, 1932*	11			12	10		3		9			50
3231 Same but from across road on burn of May 4, 1930*	38		12		10		10		19	1		126

RECORD OF OCCURRENCES *(Continued)*

	Ps. ardua	*Ps. a. curticephala*	*Ps. simplex*	*Eu. f. pulchrus*	*Ph. compressus*	*Ph. bryobius*	*Ph. setosellus*	*Ph. sphaerulus*	*Ph. boresetosus*	*Ph. olivaceus*	*Ph. setosus*	*S. diaphanus*
Connecticut												
3233 Decayed spruce stump and covering lichens, mosses and lichens of blueberry hummock, side of Bingham Pond, Aug. 6*	4		41		11	1	2			3		3
3234 Sphagnum and sedge, edge of same pond*	13		5		11	1						1
3235 as last but blueberry leaf mould, dried Aug. 12*	24	1	4		69			1				10
3239 Well decayed fallen hemlock hole bearing a little lichen, half-way up south side of Sage's Ravine, northwest Conn., Aug. 6 (dried Aug. 17).*		42		4	2	1						2
3240 Laurel litter, same spot, dried Aug. 22*	12		17	29	6		3					224
3241 Dry hemlock mould, moss and Selaginella, on cliffy rocks, same spot, dried Aug. 23*				2	6							85

RECORD OF OCCURRENCES *(Continued)*

	Ps. ardua	*Ps. a. curticephala*	*Ps. simplex*	*Eu. f. pulchrus*	*Ph. compressus*	*Ph. bryobius*	*Ph. setosellus*	*Ph. sphaerulus*	*Ph. boresetosus*	*Ph. olivaceus*	*Ph. setosus*	*S. diaphanus*
New York State												
3289–90 Pine leaf mould and duff, foot of pine tree, east slope of Pleasant Hill, Etna, N. Y. Oct. 15*		4	3						1			144
32102 Moss, foot of tree on west, wooded slope of hemlock-pine gully, same loc. Nov .3	2				2							7
3295 Epigeous moss, swamp floor, Ringwood, Tompkins Co., N. Y. Oct. 22	3		2		24			5		3		34
3296 Epigeous moss, pool margin, same loc. and date	1						3	2	2	6		1
32108 Deciduous leaf mould woods on crest of Connecticut Hill, Newfield, Tompkins Co., N. Y. Nov. 25*	3				1		3	15	17			32
32109 Pine litter, base of pine tree, same as last*			7						1			68
32110 Epigeous moss and lichens from old wood and stumps, same loc. and date*					1				1			2

RECORD OF OCCURRENCES *(Concluded)*

	Ps. ardua	*Ps. a. curticephala*	*Ps. simplex*	*Eu. f. pulchrus*	*Ph. compressus*	*Ph. bryobius*	*Ph. setosellus*	*Ph. sphaerulus*	*Ph. boresetosus*	*Ph. olivaceus*	*Ph. setosus*	*S. diaphanus*
New York State												
32111–13 Deciduous litter, small gully along road up from Cayuga Lake between Myers and Norton; Dec. 5, coll. by C. R. Crosby*	25						1	12			7	17
336 Moss from rock rim at foot of slope, south side of Taughannock Ravine, Cayuga Lake, N. Y. April 25*	3						6	7		1		2
337 Leaf mould from under ground hemlock, and from foot of an elm, on south slope 8 ft. above bottom of same ravine, April 25*	23						5	4			21	8
3310 Ground hemlock litter on ridge along bottom of same ravine, May 27	3							5			2	7
3312 Ground hemlock litter south slope, lower end same ravine, May 27*	18				1		2	12		3	6	2
3321 Fallen dead wood in beech woods on road north of Brookdale (up Six Mile Creek from Ithaca) N. Y. Aug. 20*							1	7		6		

* Other species are recorded in the text.

Although interspecific hybrids are fairly common among some of the European species of Phthiracarus (17), in our northeast, but one case of hybridization has been observed, that between *Phthiracarus compressus* and *Phthiracarus setosellus*.

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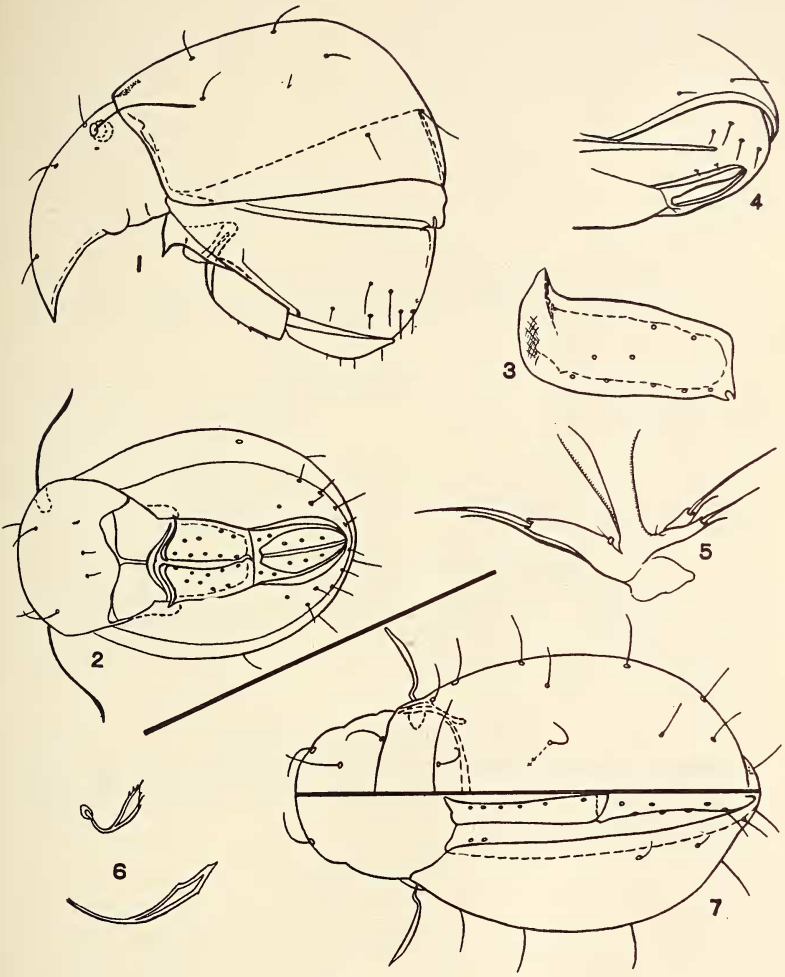
PLATE IX

Phtiracarulus laevis sp. nov.

Figure 1. Lateral aspect, legs and mouth-parts omitted; ratio × 200.
Figure 2. Ventral aspect, legs and mouth-parts omitted; ratio × 200.
Figure 3. Genital cover; ratio × 440.
Figure 4. Ventrolateral aspect of nymph III; ratio × 200.
Figure 5. Ovipositor, extruded; ratio × 330.

Protoribotritia canadaris sp. nov.

Figure 6. Pseudostigmatic organs, that above numeral is lateral aspect, that below is dorsal aspect; ratio × 440.
Figure 7. Dorso/ventral aspects, legs and mouth-parts omitted; ratio × 150.



BOX-MITES

PLATE X

Protoribotritia canadaris sp. nov.

Figure 8. Lateral aspect, legs and mouth-parts omitted; ratio × 150.

Pseudotritia ardua (18)

Figure 9. Ovipositor and genital suckers extruded, animal facing to the right; ratio × 200.

Hoplophthiracarus paludis sp. nov.

Figure 10. Dorso/ventral aspects, legs omitted; ratio × 120.

Phthiracarus anonymus amicus subsp. nov.

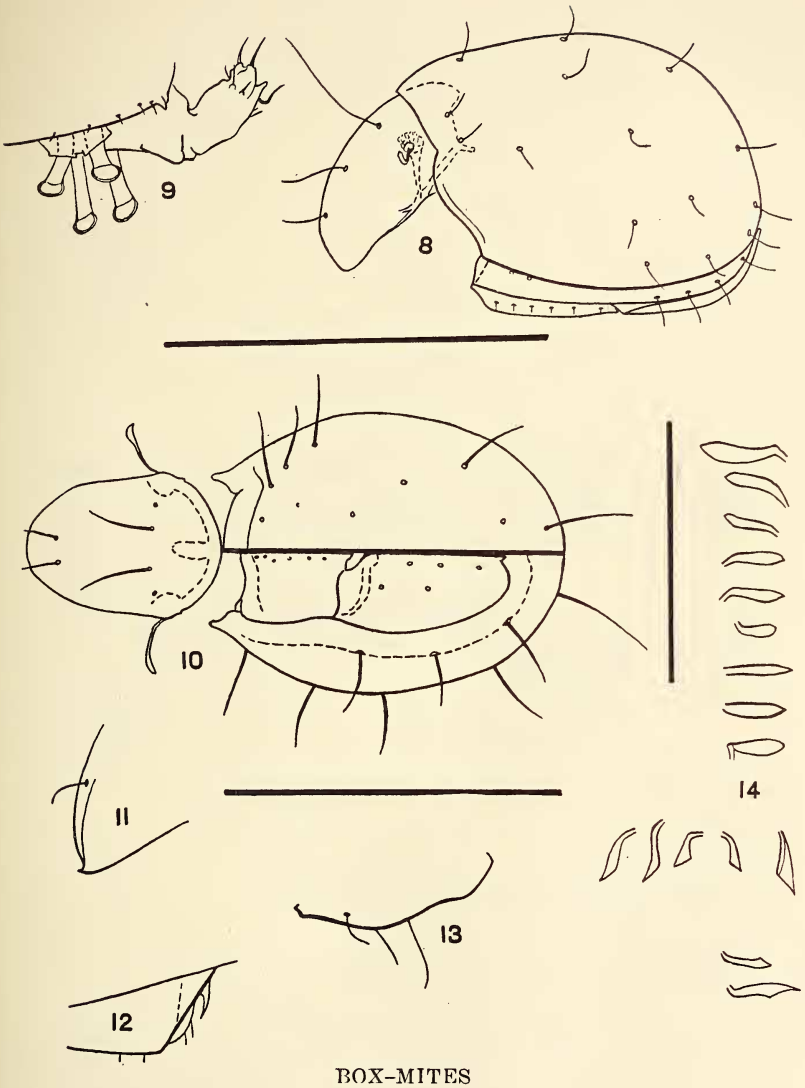
Figure 11. Anterior end of aspis; ratio × 120.

Figure 12. Anterior end of genital covers, including accessory plate horn; ratio × 120.

Figure 13. Anal cover; ratio × 120.

Phthiracarus compressus (15).

Figure 14. Pseudostigmatic organ head; figures above numeral are lateral aspect, those below numeral are dorsal aspect, the lower two are unusual, lateral aspect; free hand.



BOX-MITES

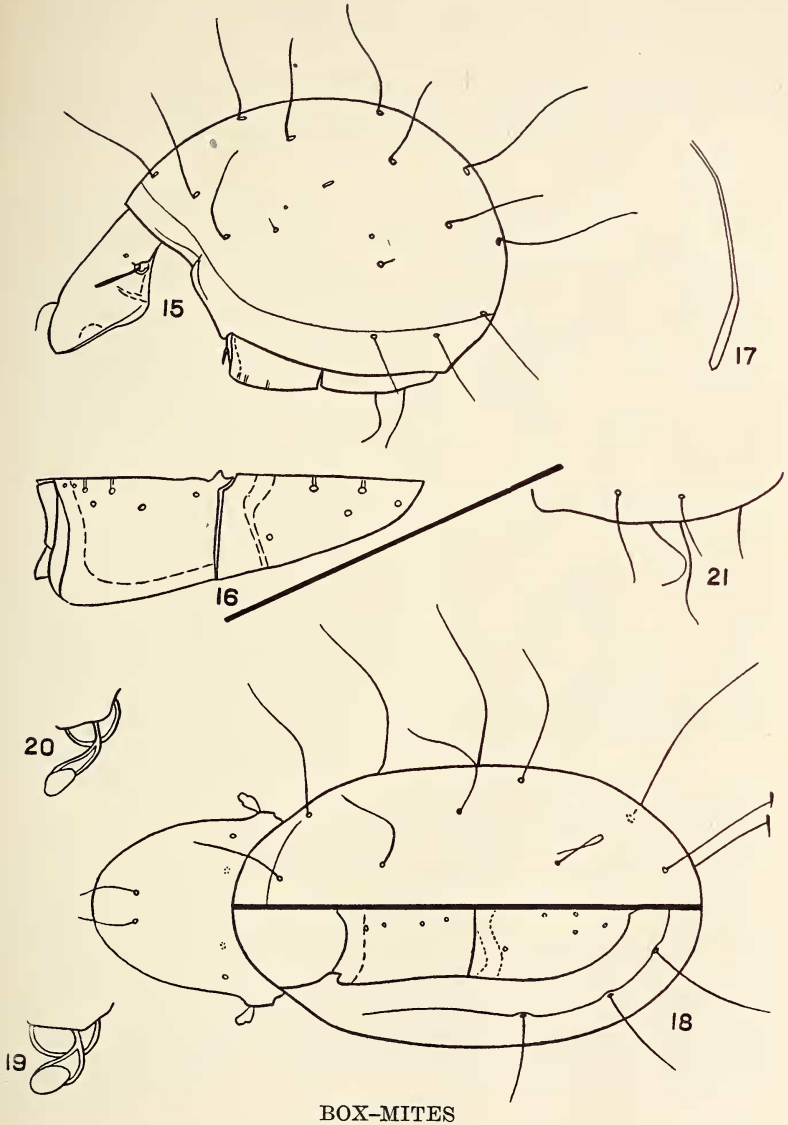
PLATE XI

Phthiracarus boresetosus (15)

Figure 15. Lateral aspect, legs and mouth-parts omitted; ratio × 150.
Figure 16. Accessory, genital and anal plates; ratio × 200.
Figure 17. Pseudostigmatic organ, dorsal aspect; ratio × 440.

Phthiracarus bryobius (15)

Figure 18. Dorso/ventral aspects, legs omitted; ratio × 120.
Figure 19. Pseudostigmatic organ, lateral aspect; ratio × 440.
Figure 20. Same, another.
Figure 21. Anal cover; ratio × 200.



BOX-MITES